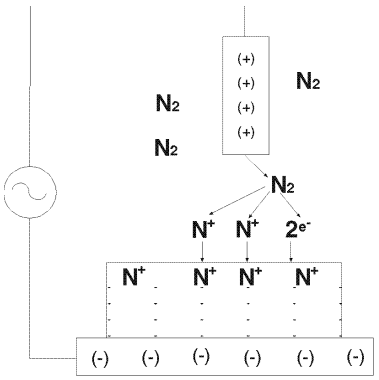
Applied Technology: Plasma (Ion) Nitriding



Concept

Plasma (sometimes called ion) Nitriding is a process for surface treatment of metal parts to make them resistant to wear and fatigue. Parts to be treated are placed in a vacuum chamber and a high DC voltage (typically around 100 volts) is established between the parts and the chamber wall. As nitrogen gas is introduced into the chamber, a glow discharge plasma (ionized gas) builds up around the parts. This plasma is highly energetic. The reactive nitrogen atoms thus bombard the surface, forming a thin layer of hard metal nitrides.

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Applications

- Surface Hardening; dies, cutting tools, parts, and molds

Technologies Replaced

- Salt Bath Nitriding (reactive ammonia and cyanide)
- Thermal Heat Treatment and Carburizing

Wastes Reduced

- Explosive Gases and Toxic Salts
- Chromium Plating wastes (from hard chrome resurfacing)
- Combustion Pollutants: ROG, COx, SOx, NOx, and Particulate

Potential in Manufacturing

Indust	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*
Food	20	LOW	Lumber	24	LOW	Chem	28	LOW	Stone	32	LOW	Elect	36	HI
Tobac	21	LOW	Furn	25	LOW	Petrol	29	LOW	Pmetal	33	LOW	Transp	37	HI
Textile	22	LOW	Paper	26	LOW	Rubber	30	LOW	MetFab	34	MED	Instr	38	MED
Apparel	23	LOW	Printing	27	LOW	Leather	31	LOW	Mach	35	HI	Misc	39	MED

Credits: **: Dr. Philip Schmidt and Dr. F.T. Sparrow;**
Unimar Group, Ltd; The Electrification Council; Electric Power Research Institute

Plasma (Ion) Nitriding
continued

Technology Advantages

- Better Product Quality
- Faster Cycle Time
- No or Little Thermal Effects
- Simpler Automation and Control
- Easy to Mask Unnitrided Areas
- Less Floor Space (1/2 other technologies)

Technology Disadvantages

- Parts Must Be Separated

Typical Costs

Capital Costs	O & M Costs	Potential Payback
higher baseline; but does not require dissociaters and cooling pits	energy costs: 1/3 labor: < other nitriding overall: ½ (salt bath) to 1 (ammonia)	< 1 year or more; very application dependent

Installations

Case A - A company producing large injection molded fiberglass components, such as outboard motors, basketball backboards, and automotive body components, replaced its chromium-plated molds with ion nitrided molds. The new molds last 5 times as many molding cycles as the chromium-plated molds before they have to be refinished. This has reduced the number of spare molds required (at $200k - $300k each) and reduced the number of mold-refinishing operations (at $25k - $40k each) by 80%. The surface quality of the molded parts is improved substantially, reducing part finishing costs.

Major Vendors

Plasma (Ion) Nitriding

Abar-Ipsen Industries
905 Pennsylvania Blvd
Feasterville, PA 19047
(215) 355-4900

Seco/Warwick Corp.
180 Mercer Street
Meadville, PA 16335
(814) 724-1400

Surface Combustion, Inc.
1700 Indian Wood Circle
Maumee, OH 43537
(419) 891-7150

This list of vendors of the indicated technology is not meant to be a complete or comprehensive listing. Mention of any product, process, service, or vendor in this publication is solely for educational purposes and should not be regarded as an endorsement by the authors or publishers.

Index to EPRI DOCUMENTS

Plasma (Ion) Nitriding

Ion Nitriding, EPRI CMF TechCommentary, Vol 2, No 5R, 1994

Ion Nitriding Injection Molds, EPRI CMF TechApplication, Vol 1, No 13, 1987

This information is designed to help you determine **potential** applications for the technology. You are encouraged to contact one of the listed vendors or a consultant for details and pricing.

This manual is not intended as a recommendation of any particular technology, process, or method. Mention of trade names, vendors, or commercial products do not constitute endorsement or recommendation for use. It is offered for educational and informational purposes and is advisory only.

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